11130

California Coastal Live Oak Woodland and Savanna

BpS Model/Description Version: Aug. 2020 2014

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| **Modelers** |  | **Reviewers** |  |
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| None | None | None | None |
| None | None | None | None |

Vegetation Type

Steppe/Savanna

Map Zones

3

Geographic Range

*Quercus agrifolia*-dominated forests, woodlands, and savannas occur in the Coast Ranges, Transverse Ranges, and Peninsular Ranges from Sonoma County to northern Baja CA.

Biophysical Site Description

This system occurs mainly below 500m elevation in foothill environments that receive 40-80cm annual precipitation, with January mean minimum daily temperatures of 5-10 degrees centigrade, and July mean maximum daily temperatures of 18-23 degrees centigrade.

Vegetation Description

Coast live oak is the dominant canopy species in a single tree stratum over a shrub or herb understory. Tree canopy closure ranges from 10-60%. Trees may be embedded in a shrub matrix of coastal sage scrub and chaparral shrub species such as *Salvia mellifera*, *Adenostoma fasciculatum*, *Heteromeles arbutifolia*, *Cercocarpus betuloides*, and *Ceanothus* spp., with a sparse understory of herbs and lianas such as Salvia spathacea, *Claytonia parviflora*, *Toxicodendron diversilobum*, and *Rubus ursinus*. Alternatively, depending mainly on disturbance history, the oaks may be embedded in a grassland matrix comprised of a diverse mix of perennial bunchgrasses (e.g., *Bromus carinatus* and *Nasella pulchra*), shrubs (e.g., *Lessingia filaginifolia* and *Baccharis pilularis*), annual grasses, and forbs.

Coast live oak is shade tolerant and recruits into both chaparral and coastal sage scrub on many substrates as well as into more mesic settings such as north-facing slopes and areas bordering riparian areas. Coast live oak is also one of the most fire-resistant oaks in CA. Seedlings and saplings can survive relatively low-intensity surface fires. Adult trees exhibit a number of fire adaptations, including dense outer bark, a thick inner bark with high insulating capacity, and an ability to re-sprout from the base and crown following severe wildfires. Adult survival rates >95% have been documented following severe wildfire. Mortality rates are higher for late season fires and for oaks growing among chaparral shrubs. The oak canopy often recovers more rapidly after fire than other elements of the vegetation, contributing in part to the heterogeneous structure and composition of this type, depending on fire history.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| QUAG | *Quercus agrifolia* | California live oak |
| HETER5 | *Heteromeles* | Toyon |
| TOXIC | *Toxicodendron* | Poison oak |
| BRCA5 | *Bromus carinatus* | California brome |
| RUUR | *Rubus ursinus* | California blackberry |
| NAPU4 | *Nassella pulchra* | Purple tussockgrass |

Species names are from the NRCS PLANTS database. Check species codes at http://plants.usda.gov.

Disturbance Description

Fire is the dominant disturbance mechanism. Fire severity can range from high in oak woodlands with a high shrub component to moderate or low in open woodlands and savannas with a grass understory. Lightning-ignited fires are uncommon but human-ignited fires may occur frequently given the propensity of aboriginal cultures to burn foothill environments (Keeley 2002).

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 173 | 8 |  |  |
| Moderate (Mixed) | 31 | 42 |  |  |
| Low (Surface) | 26 | 50 |  |  |
| All Fires | 13 | 100 |  |  |

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is the central tendency modeled. Percent of all fires is the percent of all fires modeled in that severity class. Minimum and Maximum FIs show the relative range of fire intervals as estimated by model contributors, if known.

Scale Description

Patchy distribution controlled by geology, topography, soils, and fire (e.g., Wells 1962, Callaway and Davis 1993).

Adjacency or Identification Concerns

Can be adjacent to chaparral, coastal scrub, oak forest, mixed evergreen forest, and riparian forest. Fire frequency and severity would be regulated in part by these adjacent ecosystems.

Issues or Problems

This is an extremely heterogeneous system whose shrub and herb layers have been extensively modified by grazing, exotic species, and altered fire regimes. The historical fire regime is not well understood, as *Quercus agrifolia* cannot be reliably aged and thus is not amenable to fire scar analysis.

This type is subject to the threats of grazing, conversion of understory to exotic annual grasses, fire suppression, and residential development.

Native Uncharacteristic Conditions

Comments

**Succession Pathways**

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:CLS | 20 |
| Late1:OPN | 21 | Late1:OPN | 999 |
| Mid1:CLS | 21 | Mid1:CLS | 999 |
| Early1:ALL | 0 | Mid1:CLS | 20 |
| Late1:OPN | 21 | Late1:OPN | 999 |
| Mid1:CLS | 21 | Mid1:CLS | 999 |

**Disturbance Pathways**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Disturbance Type** | **Disturbance occurs In** | **Moves vegetation to** | **Disturbance Probability** | **Return Interval (yrs)** | **Reset Age to New Class Start Age After Disturbance?** | **Years Since Last Disturbance** |
| MixedFire | Early1:ALL | Early1:ALL | 0.0500 | 20 | No |  |
| ReplacementFire | Early1:ALL | Early1:ALL | 0.0040 | 250 | No |  |
| SurfaceFire | Early1:ALL | Early1:ALL | 0.1000 | 10 | No |  |
| ReplacementFire | Late1:OPN | Early1:ALL | 0.0050 | 200 | Yes |  |
| MixedFire | Late1:OPN | Late1:OPN | 0.0200 | 50 | No |  |
| SurfaceFire | Late1:OPN | Late1:OPN | 0.0200 | 50 | No |  |
| AltSuccession | Late1:OPN | Mid1:CLS | 1.0000 | 1 | Yes | 20 |
| Insect/Disease | Mid1:CLS | Early1:ALL | 0.0010 | 1,000 | Yes |  |
| ReplacementFire | Mid1:CLS | Early1:ALL | 0.0100 | 100 | Yes |  |
| MixedFire | Mid1:CLS | Late1:OPN | 0.0670 | 15 | Yes |  |
| SurfaceFire | Mid1:CLS | Late1:OPN | 0.0670 | 15 | Yes |  |
| MixedFire | Early1:ALL | Early1:ALL | 0.0500 | 20 | No |  |
| ReplacementFire | Early1:ALL | Early1:ALL | 0.0040 | 250 | No |  |
| SurfaceFire | Early1:ALL | Early1:ALL | 0.1000 | 10 | No |  |
| ReplacementFire | Late1:OPN | Early1:ALL | 0.0050 | 200 | Yes |  |
| MixedFire | Late1:OPN | Late1:OPN | 0.0200 | 50 | No |  |
| SurfaceFire | Late1:OPN | Late1:OPN | 0.0200 | 50 | No |  |
| AltSuccession | Late1:OPN | Mid1:CLS | 1.0000 | 1 | Yes | 20 |
| Insect/Disease | Mid1:CLS | Early1:ALL | 0.0010 | 1,000 | Yes |  |
| ReplacementFire | Mid1:CLS | Early1:ALL | 0.0100 | 100 | Yes |  |
| MixedFire | Mid1:CLS | Late1:OPN | 0.0670 | 15 | Yes |  |
| SurfaceFire | Mid1:CLS | Late1:OPN | 0.0670 | 15 | Yes |  |

Succession Classes

**Mapping Rules**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Upper Layer Lifeform** | **Height (m)** | **Canopy Cover (%)** | | | | | | | | | |
| **0-10** | **11-20** | **21-30** | **31-40** | **41 - 50** | **51-60** | **61-70** | **71-80** | **81-90** | **91-100** |
| Herb | 0-0.5 | A | A | A | A | A | A | A | A | A | A |
| Herb | 0.5-1.0 | A | A | A | A | A | A | A | A | A | A |
| Herb | >1.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 0-0.5 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 0.5-1.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 1.0-3.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | >3.0 | A | A | A | A | A | A | A | A | A | A |
| Tree | 0-5 | A | A | A | A | A | A | A | A | A | A |
| Tree | 5-10 | B | B | B | B | B | B | B | B | B | B |
| Tree | 10-25 | C | C | C | C | C | C | C | C | C | C |
| Tree | 25-50 | C | C | C | C | C | C | C | C | C | C |
| Tree | >50 | C | C | C | C | C | C | C | C | C | C |

Succession class letters A-E are described in the Succession Class Description section. Some classes use a leafform distinction where a qualifier is added to the class letter: Brdl (broadleaf), Con (conifer), or Mix (mixed conifer and broadleaf). UN refers to uncharacteristic native or a combination of height and cover that would not be expected under the reference condition. NP refers to not possible or a combination of height and cover which is not physiologically possible for the species in the BpS.

**Description**

Class A 11 Early Development 1 - All Structures

Upper Layer Lifeform: Tree

Upper Layer Canopy Cover: 0 - 30%

Upper Layer Canopy Height: Tree 0m - Tree 5m

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUAG | Quercus agrifolia | California live oak | Upper |

Description

Fire-following forbs, re-sprouting bunchgrasses and understory woody perennials, and re-sprouting oak saplings and trees.

Succession to Class B after about 20yrs without fire. Replacement fire severe enough to kill most overstory oaks resets age, but this is unlikely at this stage due to lack of enough fuel to generate fire severe enough to kill fire-tolerant oaks. Mixed fire or surface fires are more likely given stand structure and will tend to promote open woodland/savanna of old/larger fire-tolerant oaks with grass and sub-shrub understory. Mixed fire can remove the regenerating shrub and sapling components but will have little effect on tree layer. Surface fire has little effect on stand structure except to thin the shrub/sapling layer and remove above-ground herbaceous material.

*Maximum Tree Size Class*  
Medium 9-21"DBH

Class B 19 Mid Development 1 - Closed

Upper Layer Lifeform: Tree

Upper Layer Canopy Cover: 21 - 40%

Upper Layer Canopy Height: Tree 5.1m - Tree 10m

Upper Layer Lifeform is not the dominant lifeform

Class B has a shrub component to the understory.

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUAG | Quercus agrifolia | California live oak | Upper |

Description

Oak canopy >20% contributed by oaks that survived replacement fire plus new recruits. Understory and shrub layer are variable in composition but shrub cover is generally >20%. Shrub layer promotes recruitment of new *Q. agrifolia* saplings but also increases the risk of severe fire.

Stays in Class B unless disturbance occurs. Replacement fires at this stage are more likely given higher fuel loads, and reset to Class A. Mixed fire or surface fire will open the vegetation to Class C. Insects and disease that kill overstory oaks have a low annual probability of occurring and converting to Class A.

*Maximum Tree Size Class*  
Large 21-33"DBH

Class C 70 Late Development 1 - Open

Upper Layer Lifeform: Tree

Upper Layer Canopy Cover: 21 - 60%

Upper Layer Canopy Height: Tree 10.1m - Tree 25m

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUAG | Quercus agrifolia | California live oak | Upper |

Description

Oak canopy >20%. Large, fire-tolerant oaks with low understory dominated by small shrubs. These canopies are usually 15-20m in height. Most stands in this state are generally 60yrs or older.

Replacement fires are unlikely given the fuel structure, and reset to Class A. Mixed and surface fire are less likely on most of the range. However, near Native American settlements it would be a greater likelihood. Without fire, the stand will eventually close in to a Class B.

*Maximum Tree Size Class*  
Very Large >33"DBH

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:CLS | 20 |
| Mid1:CLS | 21 | Mid1:CLS | 999 |
| Late1:OPN | 21 | Late1:OPN | 999 |

Probabilistic Transitions

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Disturbance Type** | **Disturbance occurs In** | **Moves vegetation to** | **Disturbance Probability** | **Return Interval (yrs)** | **Reset Age to New Class Start Age After Disturbance?** | **Years Since Last Disturbance** |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.004 | 250 | Yes | 0 |
| Mixed Fire | Early1:ALL | Early1:ALL | 0.05 | 20 | No | 0 |
| Surface Fire | Early1:ALL | Early1:ALL | 0.1 | 10 | No | 0 |
| Insects or Disease | Mid1:CLS | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Surface Fire | Mid1:CLS | Late1:OPN | 0.067 | 15 | Yes | 0 |
| Mixed Fire | Mid1:CLS | Late1:OPN | 0.067 | 15 | Yes | 0 |
| Alternative Succession | Late1:OPN | Mid1:CLS | 1 | 1 | Yes | 20 |
| Replacement Fire | Late1:OPN | Early1:ALL | 0.005 | 200 | Yes | 0 |
| Surface Fire | Late1:OPN | Late1:OPN | 0.02 | 50 | No | 0 |
| Mixed Fire | Late1:OPN | Late1:OPN | 0.02 | 50 | No | 0 |

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